



Reticle schematic

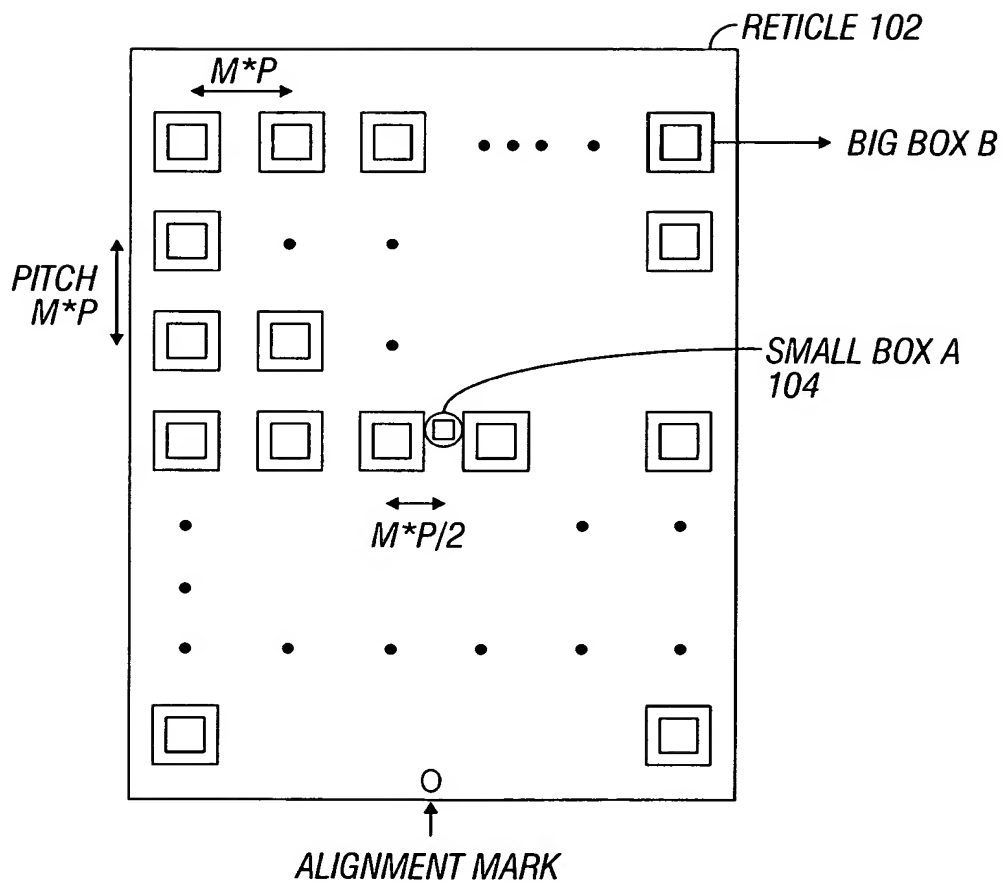


FIG. 1
(Prior Art)

Schematics for FIG. 1

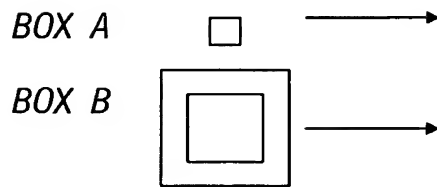


FIG. 2
(Prior Art)

Reticle Features

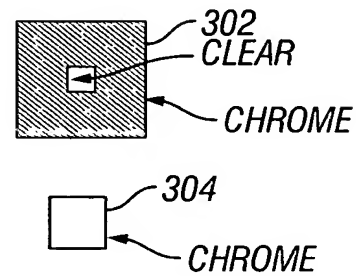


FIG. 3
(Prior Art)

Overlapping regions

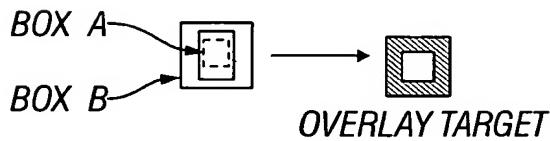


FIG. 4
(Prior Art)

**Perfectly centered
Box-in-Box structure**

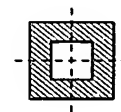


FIG. 4A
(Prior Art)

Schematic for outer box 2



FIG. 5

Outer box 2 as printed on wafer.
 Dark=unexposed, white=exposed



FIG. 6

Schematic for inner box 1



FIG. 7

Inner box 1 as printed on wafer.
 Dark=unexposed, white=exposed

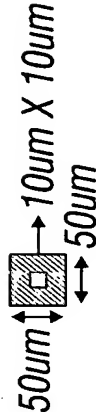


FIG. 8

Schematic for 2-dimensional 4XOL reticle

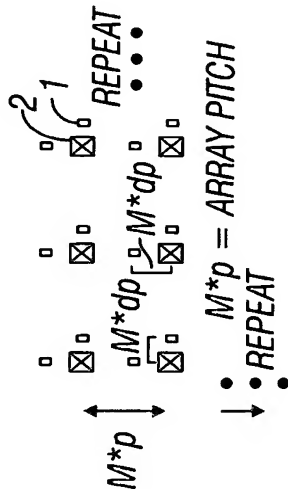


FIG. 9

Typical 4XOL reticle overlay set as projected
 onto wafer (3 featured parts); dark=unexposed,
 white=exposed

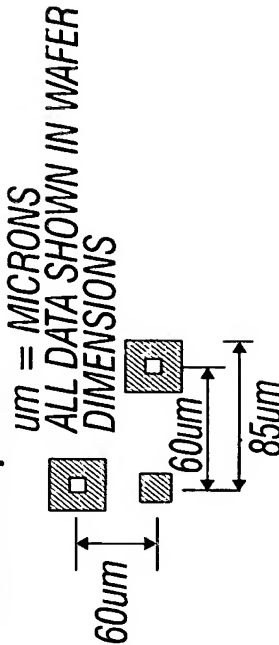


FIG. 10

Schematic of X-shear overlay on wafer

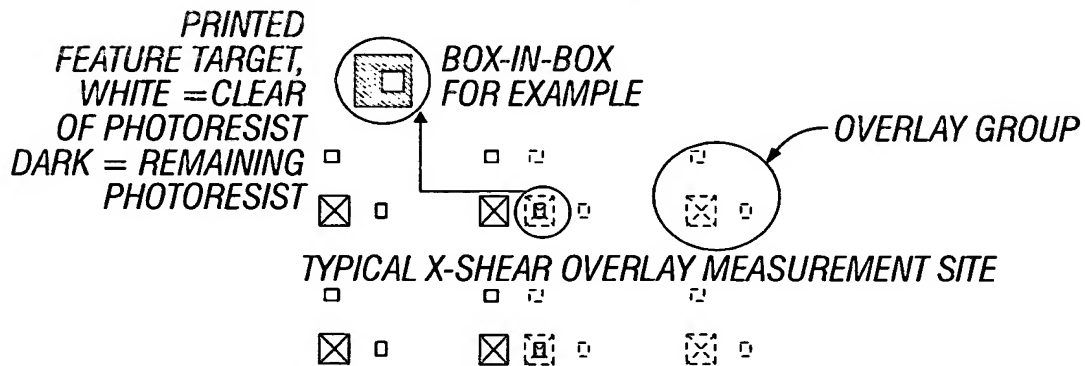


FIG. 11

Schematic of Y-shear overlay on wafer

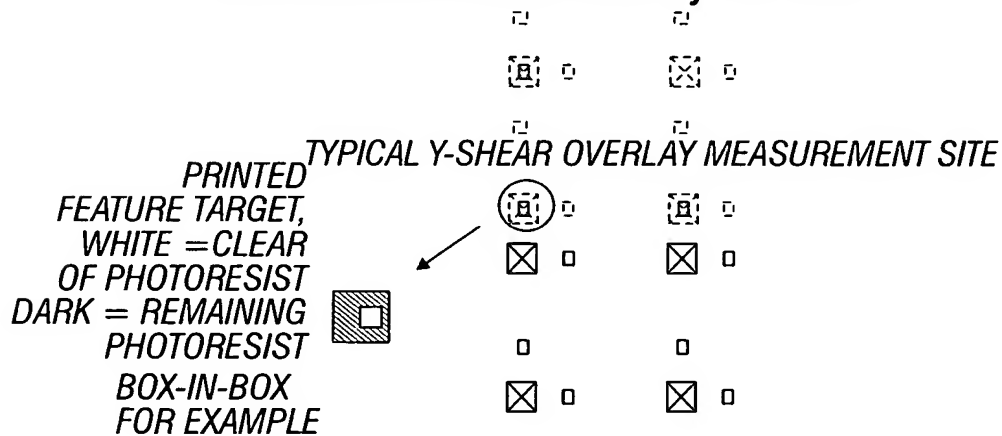


FIG. 12

2-Dimesional reticle schematice, 90 degree overlay or R-shear.

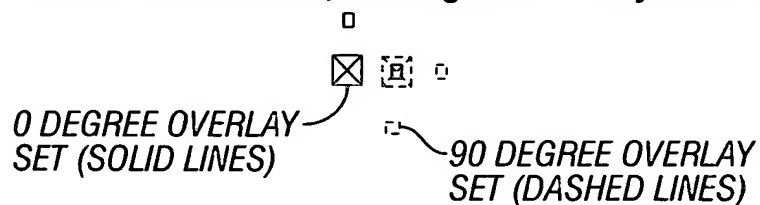


FIG. 13

Typical overlay patterns or completed alignment attributes

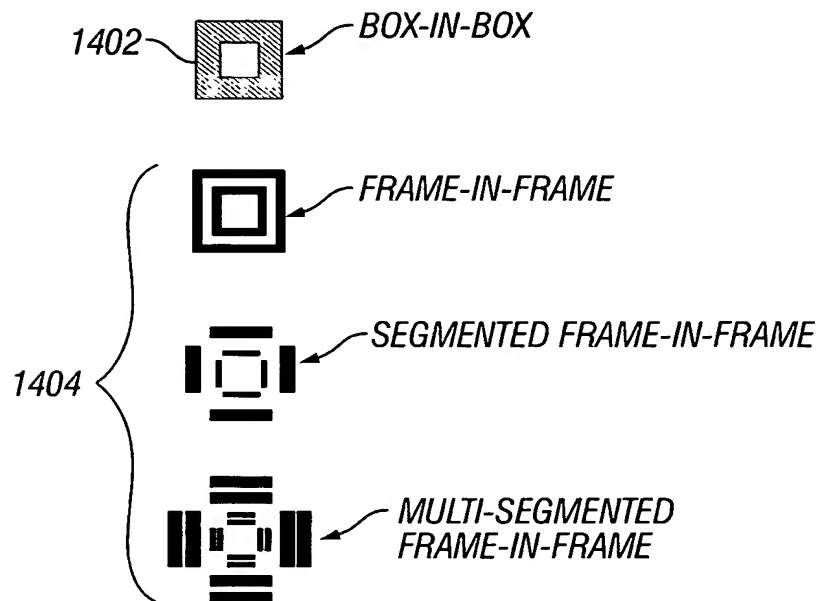


FIG. 14

**Process-flow for the second embodiment for self-referencing
 lens distortion measurement.**

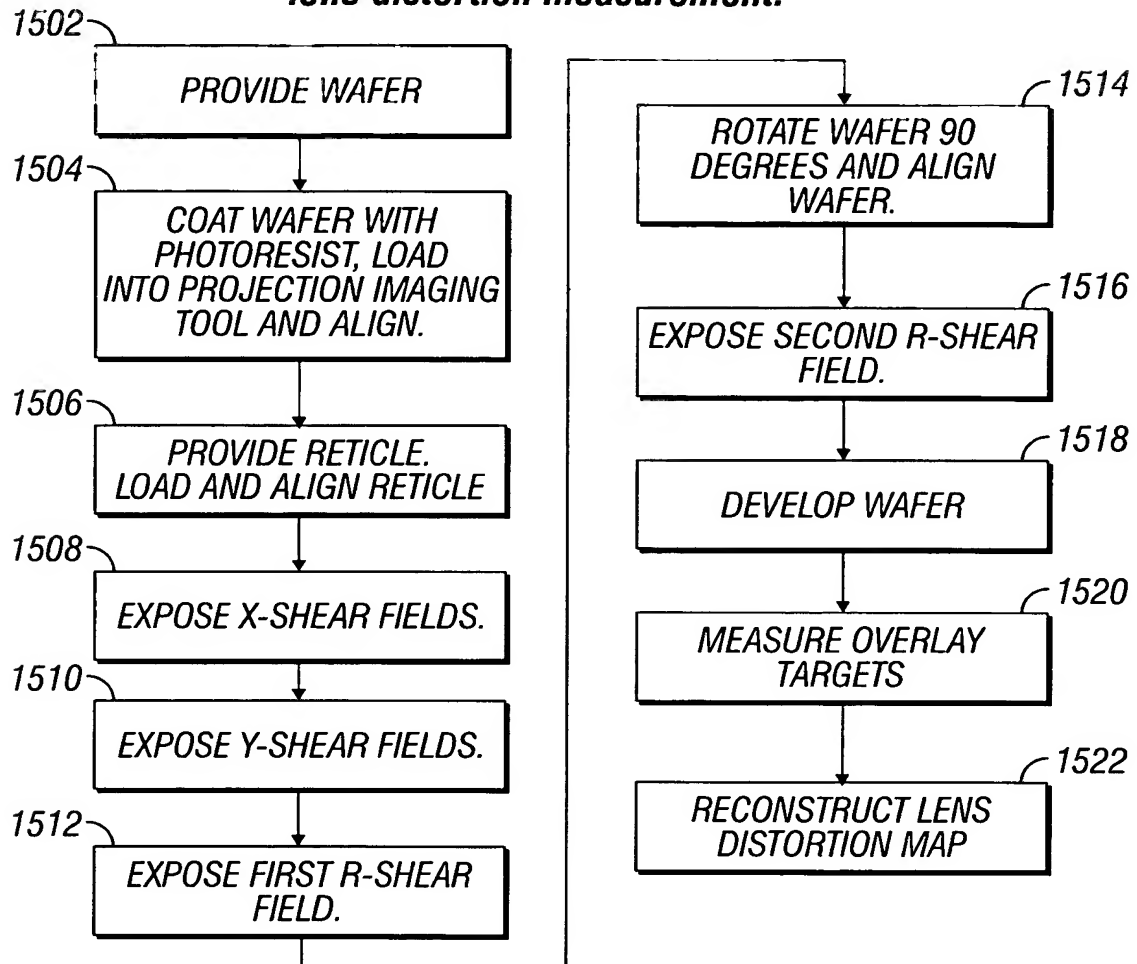


FIG. 15

**Some components of overlay or placement error
 (Inter-field and Intra-field)**



FIG. 16

Photolithographic stepper or scanner system

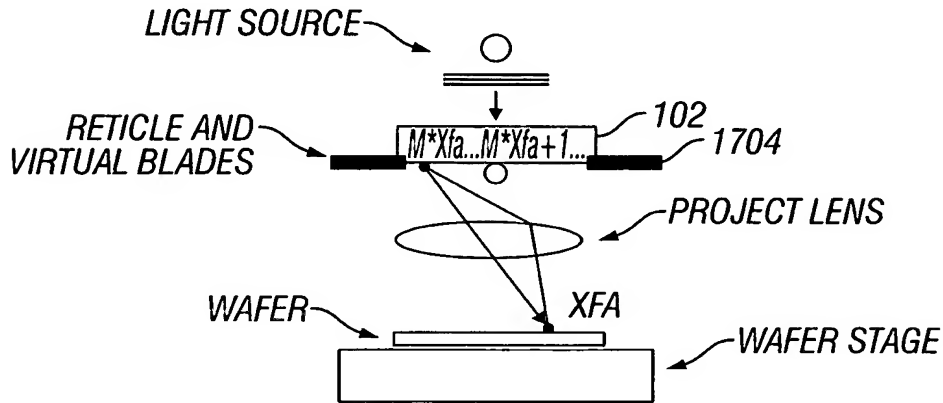


FIG. 17
(Prior Art)

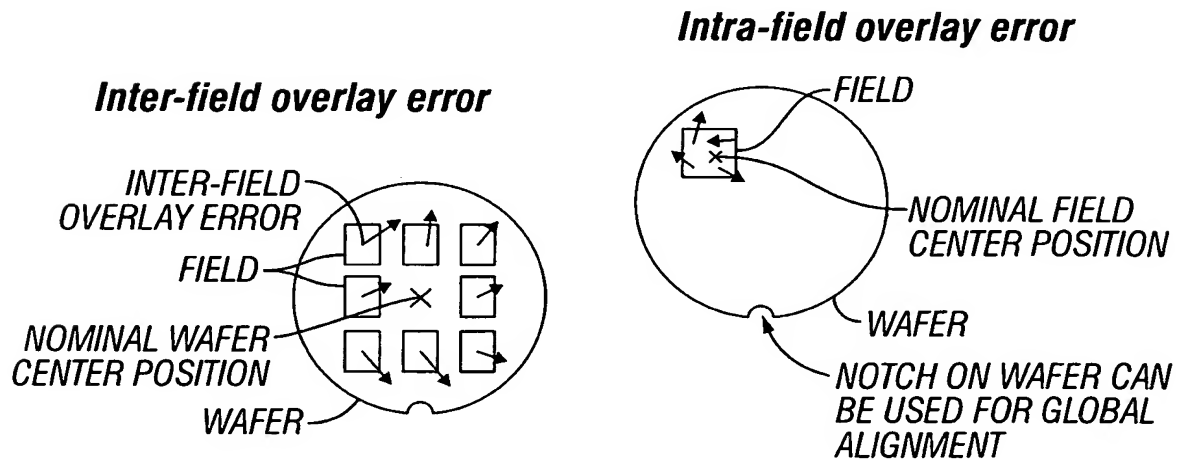


FIG. 18
(Prior Art)

FIG. 19
(Prior Art)

New Overlay reticle

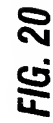


FIG. 20A

Intra-field indices projected onto the wafer

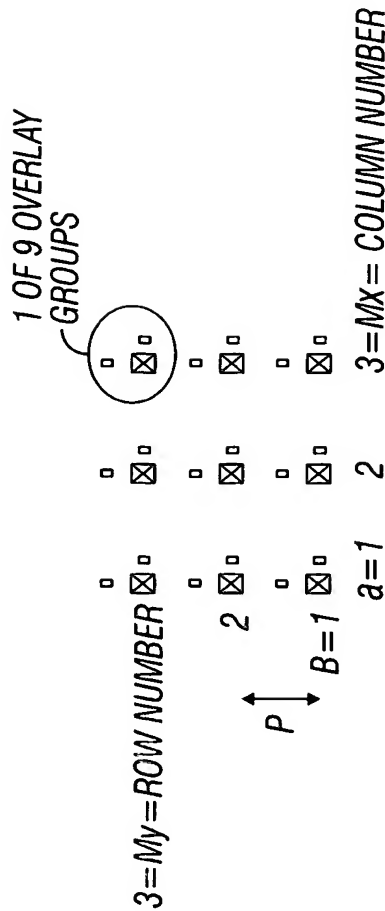


FIG. 20B

Side view of reticle of
FIG. 20

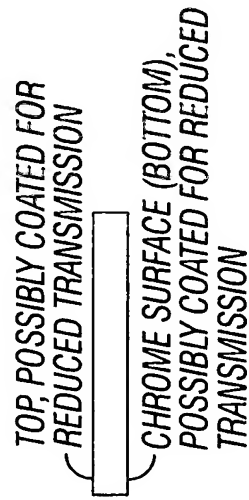


FIG. 20C

REPLACEMENT SHEET
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***Example of prior art lens
distortion test***

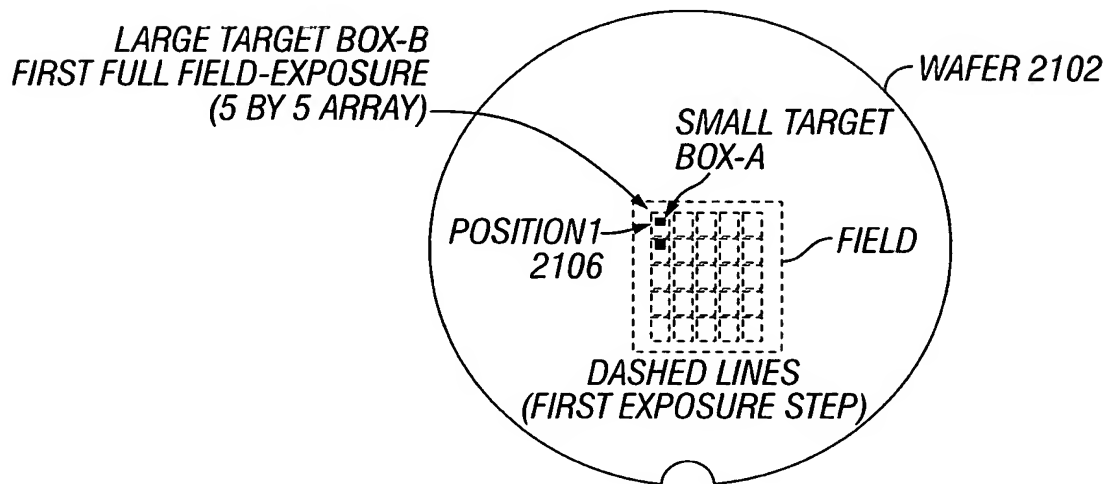


FIG. 21
(Prior Art)

Wafer with alignment marks at 0 and 90 degrees

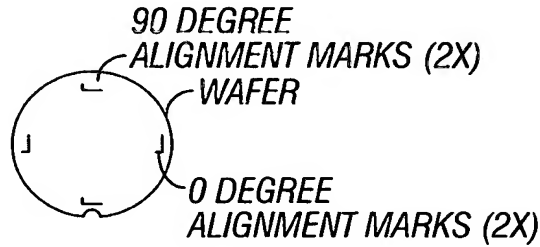


FIG. 22

Wafer after exposure of FIG. 20 overlay reticle at the 0 degree orientation

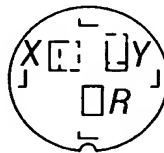


FIG. 23

Wafer after exposure of FIG. 20 overlay reticle at the 0 and 90 degree orientations (clockwise)

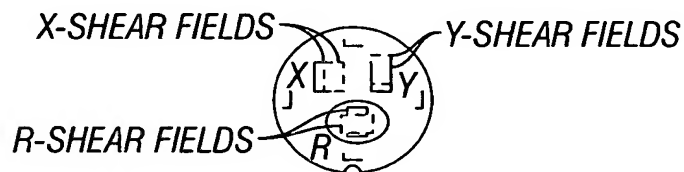


FIG. 24

Detail of R-shear pattern on wafer

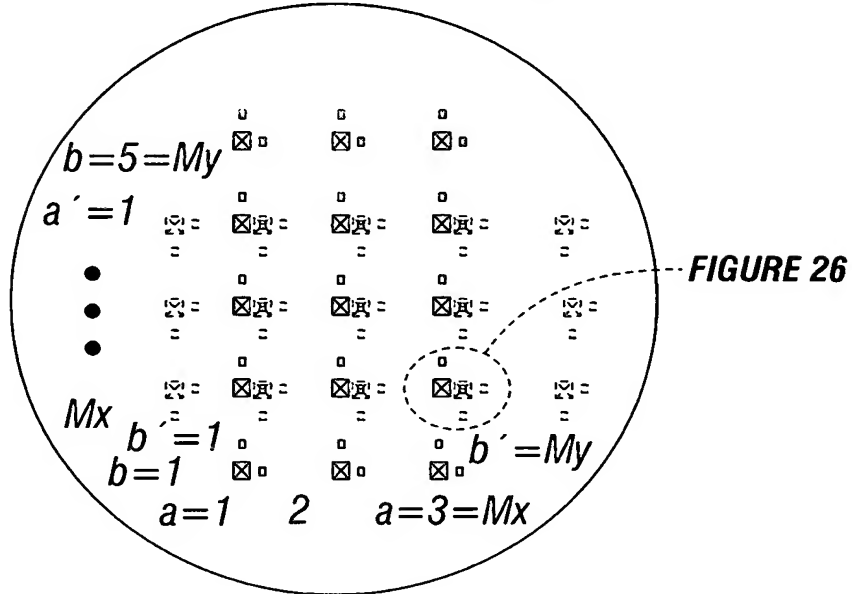


FIG. 25

Closeup of overlay groups for R-shear

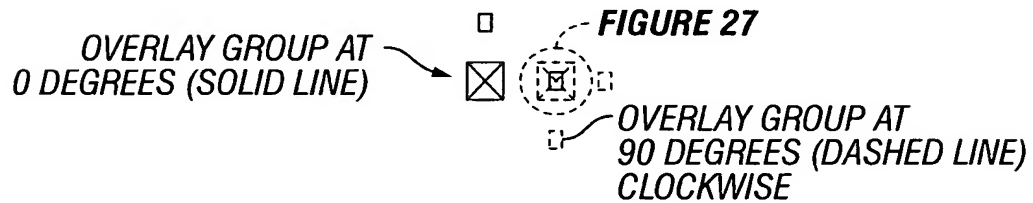


FIG. 26

Single Box-in-Box target.
Dark=undeveloped photoresist
white=no photoresist

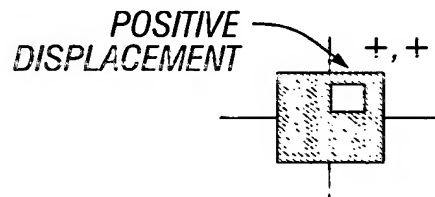
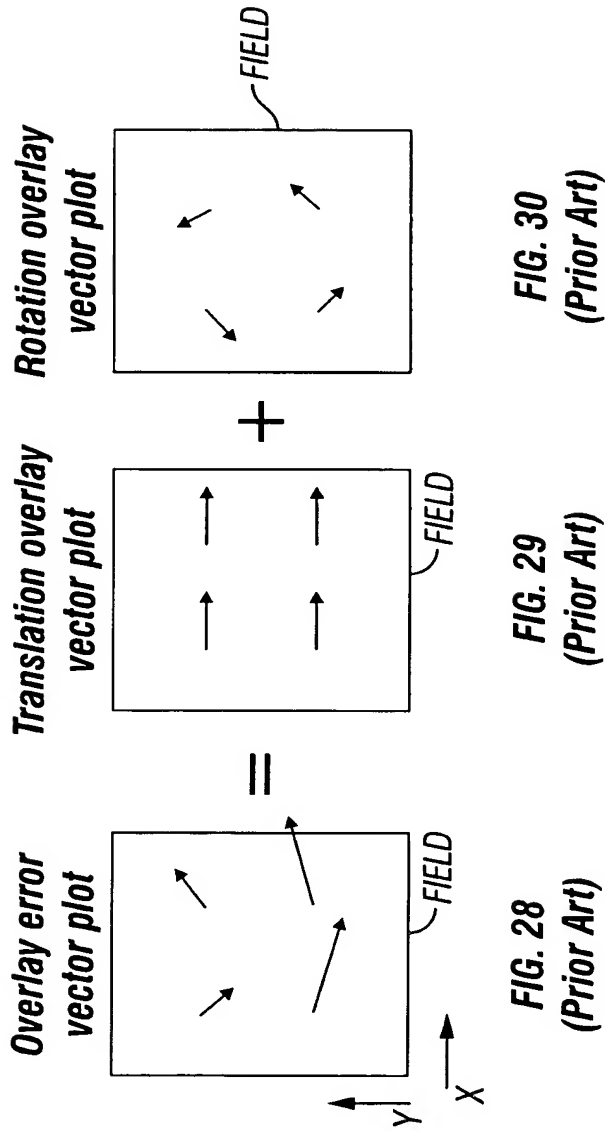


FIG. 27



Overlay measurement

THE VECTOR REPRESENTS THE ALIGNMENT
OFFSET DISTANCE BETWEEN THE BOX-IN-BOX
STRUCTURE

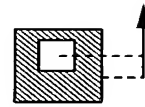


FIG. 31
(Prior Art)

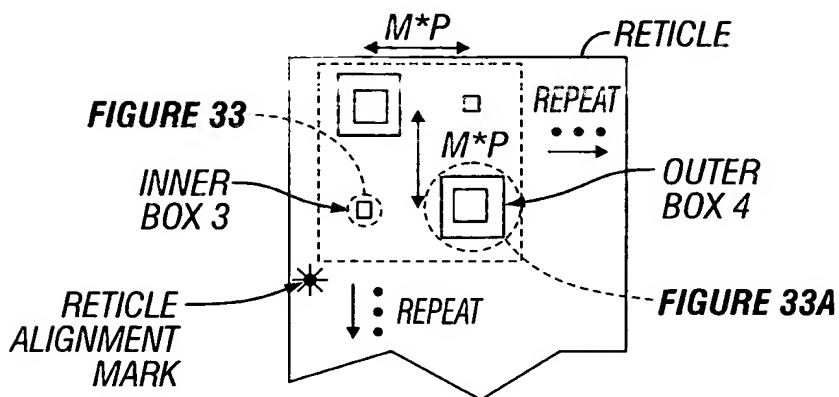


FIG. 32

Inner box 3 on reticle.
Dark=chrome,
white=open.

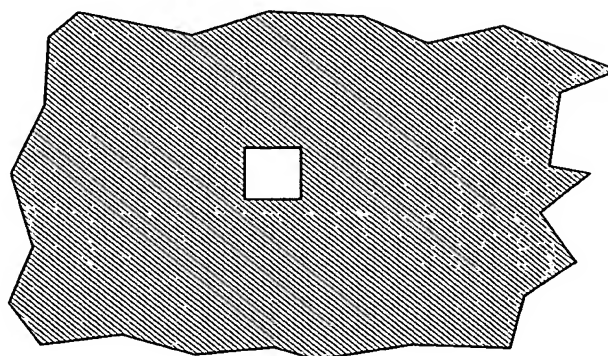
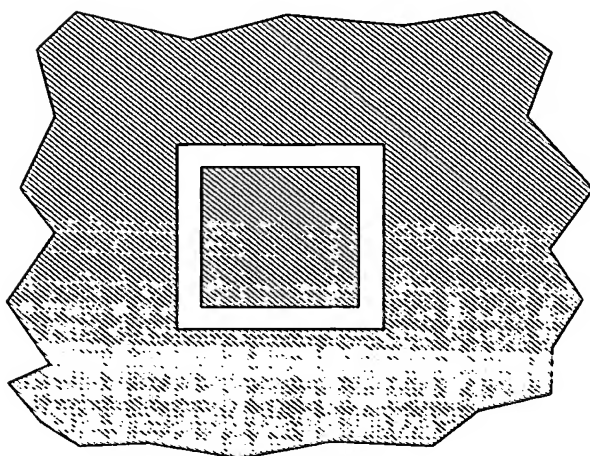


FIG. 33



Outer box 4 on reticle.
Dark=chrome,
white=open.

FIG. 33A

***Process flow for the preferred
embodiment for self-referencing
lens distortion measurement.***

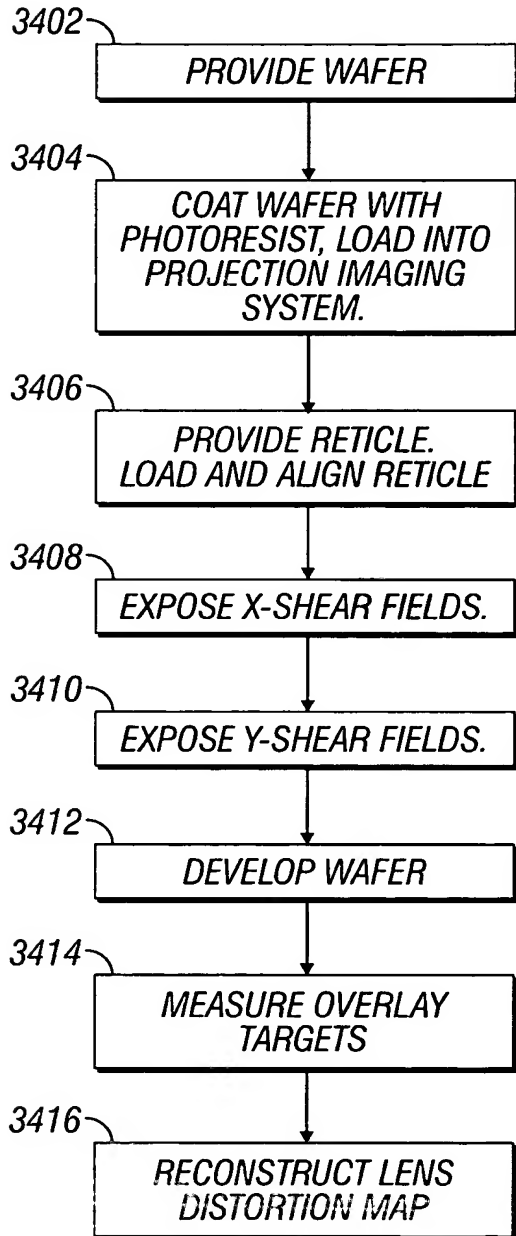


FIG. 34

***Process flow for the alternate
embodiment utilizing sub-Eo
exposure doses on the wafer.***

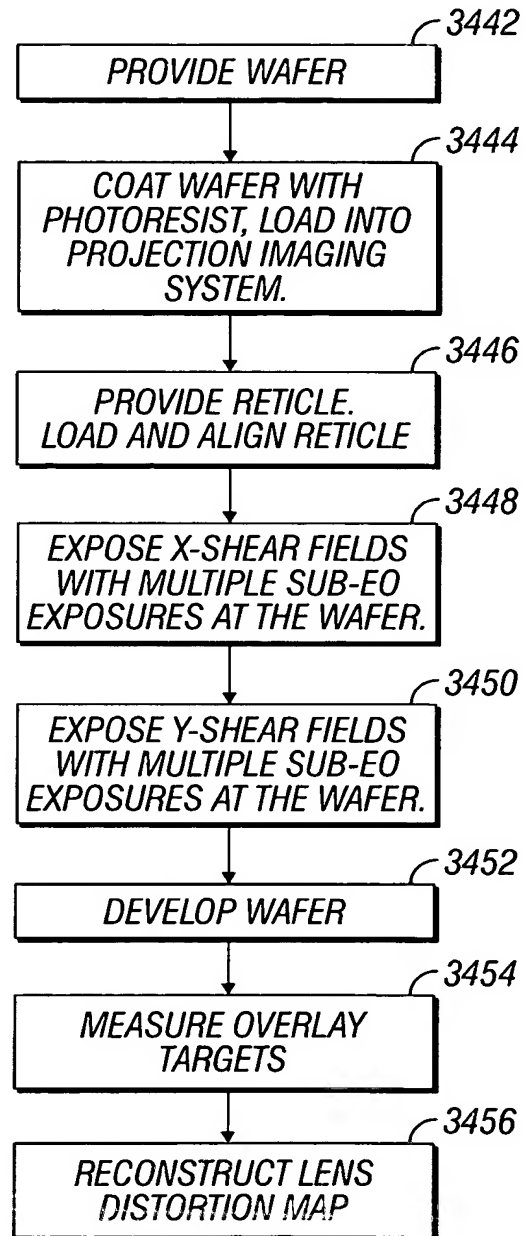
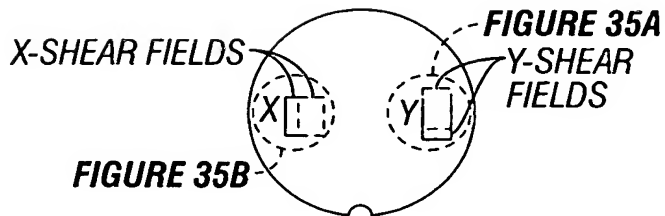


FIG. 34A

REPLACEMENT SHEET

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**Wafer after exposure of
 FIG. 20 overlay reticle for
 X and Y shears.**

FIG. 35

**Detail of Y-shear for a 2 x 2
 set of overlay groups**

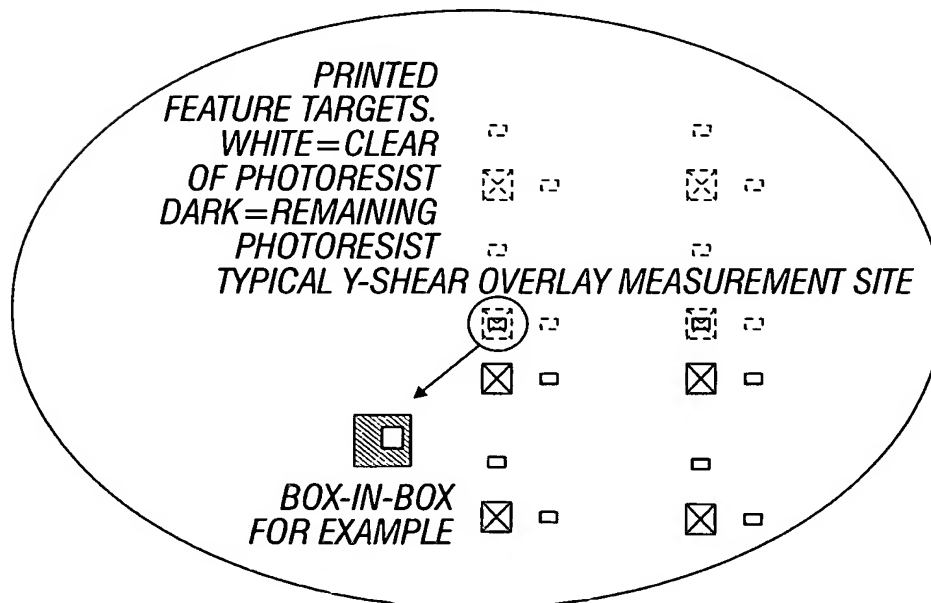


FIG. 35A

DETAIL OF X-SHEAR FOR A 2 x 2
 SET OF OVERLAY GROUPS

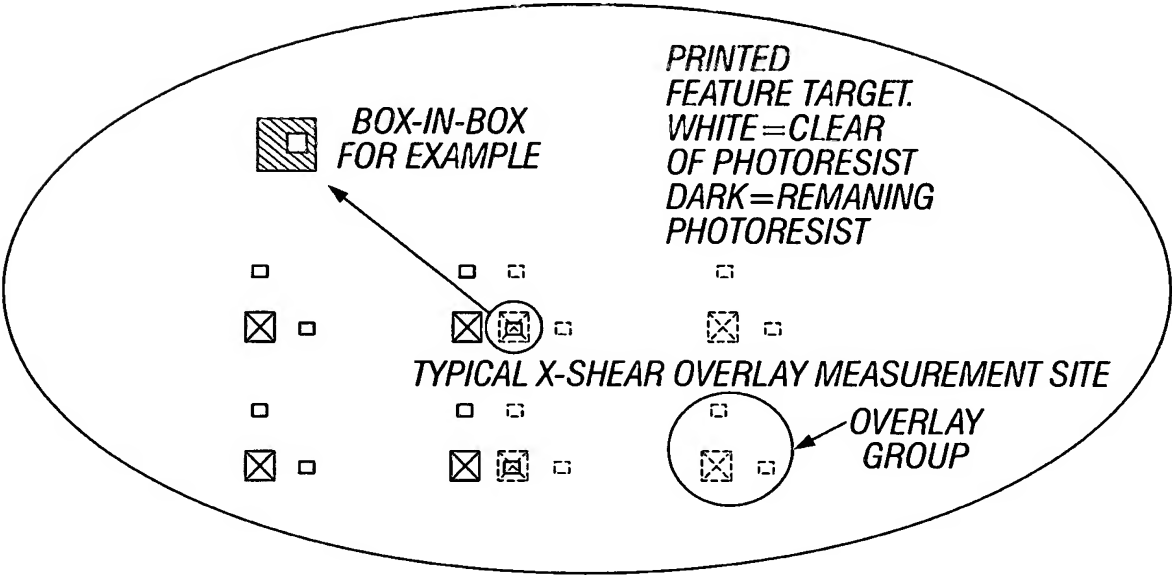


FIG. 35B

FINAL RESULTS OF THE METHOD OF THIS INVENTION.
 UNITS=MICRONS, (xf,yf) = INTRA-FIELD LOCATION,
 (dxf, dyf) = INTRA-FIELD DISTORTION AT POINT (xf, yf).

Machine id: DUVF11-02			
Xf	yf	dxf	dyf
-10000.000	-10000.000	-0.139	0.044
-8000.000	-10000.000	0.223	-0.233
-6000.000	-10000.000	0.498	0.004
⋮	⋮	⋮	⋮
10000.000	10000.000	0.099	-0.188

FIG. 36

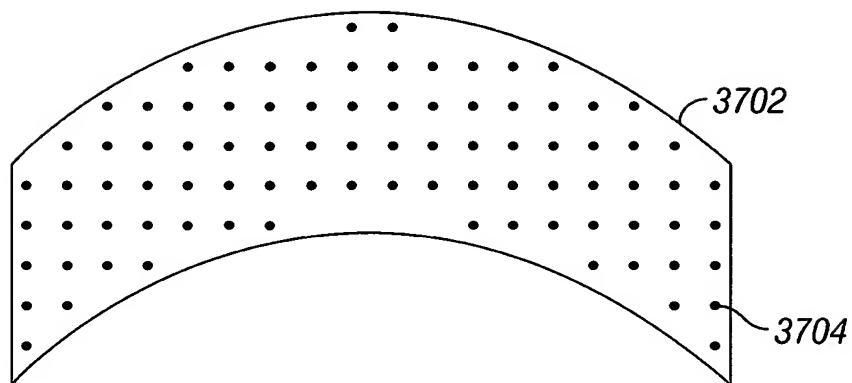


FIG. 37

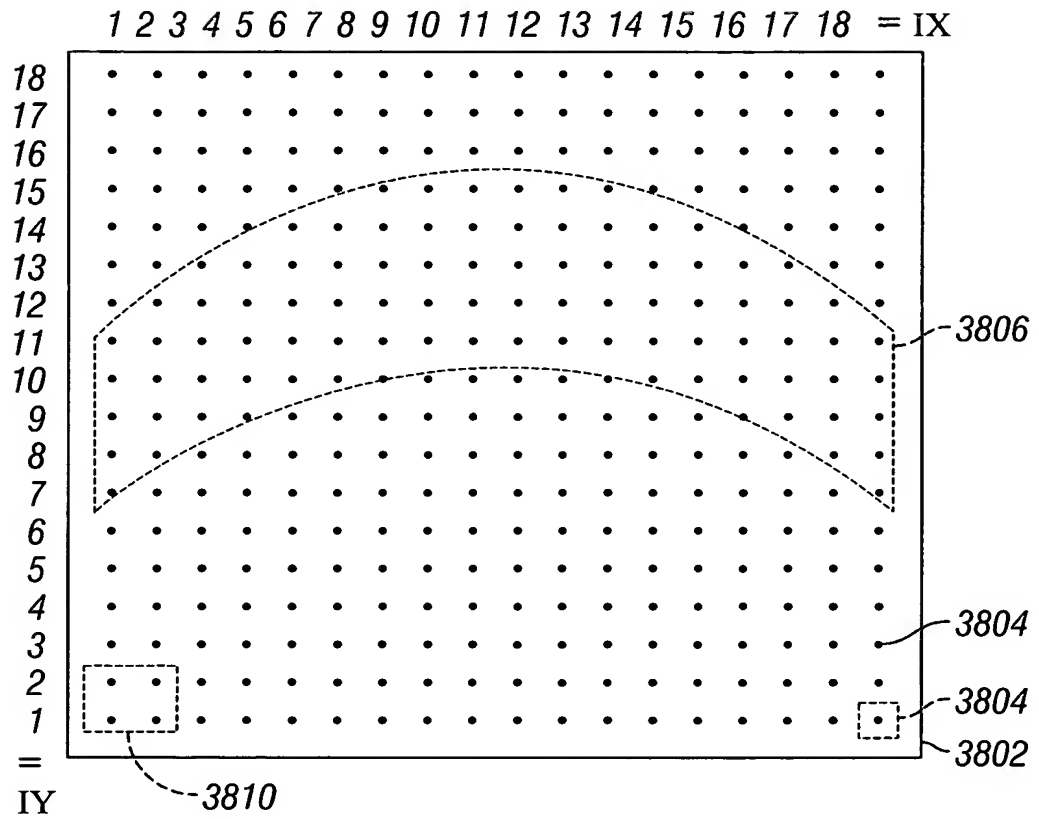


FIG. 38

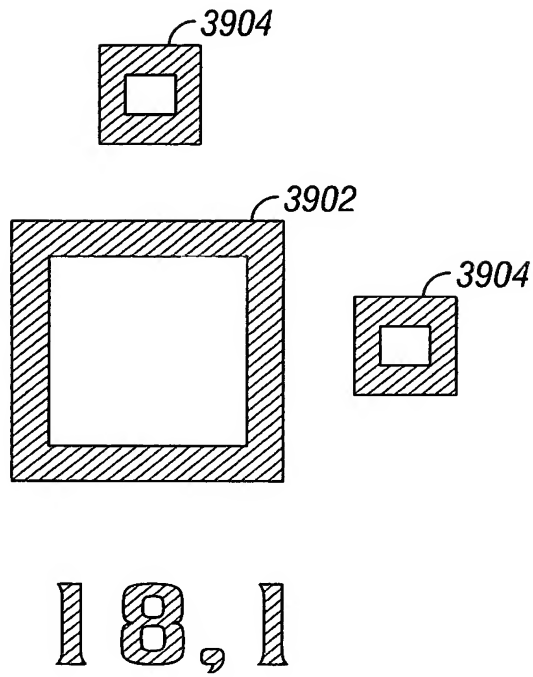


FIG. 39

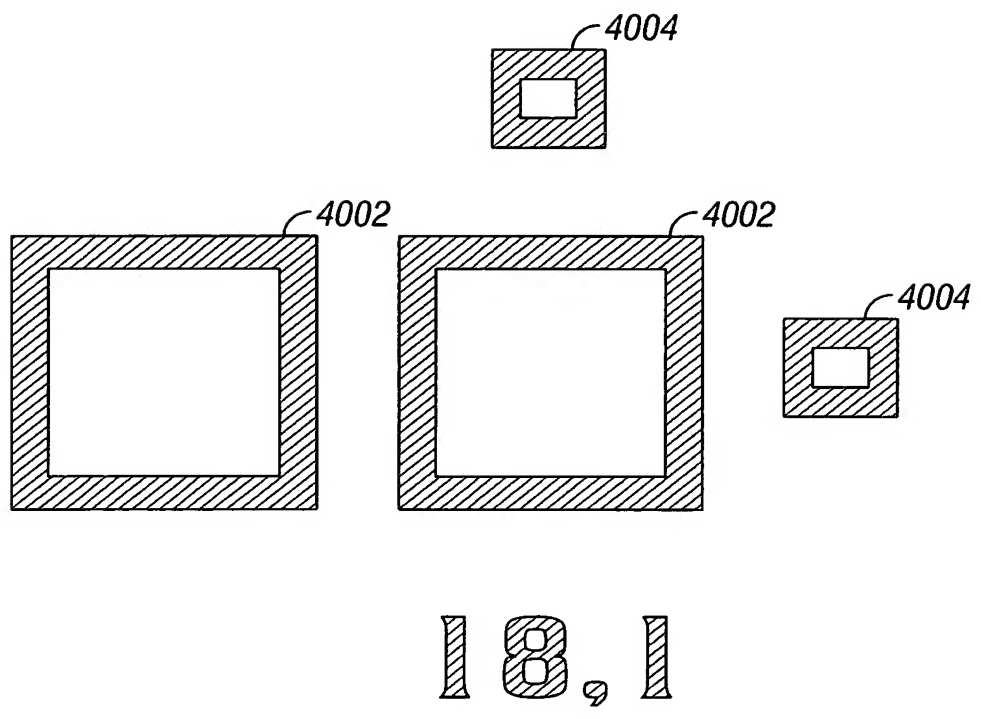


FIG. 40

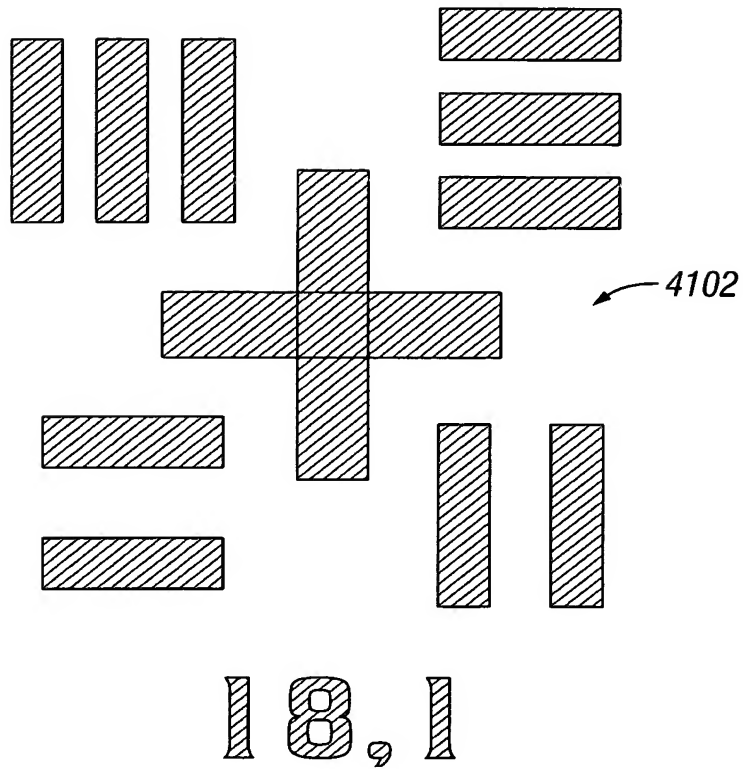


FIG. 41

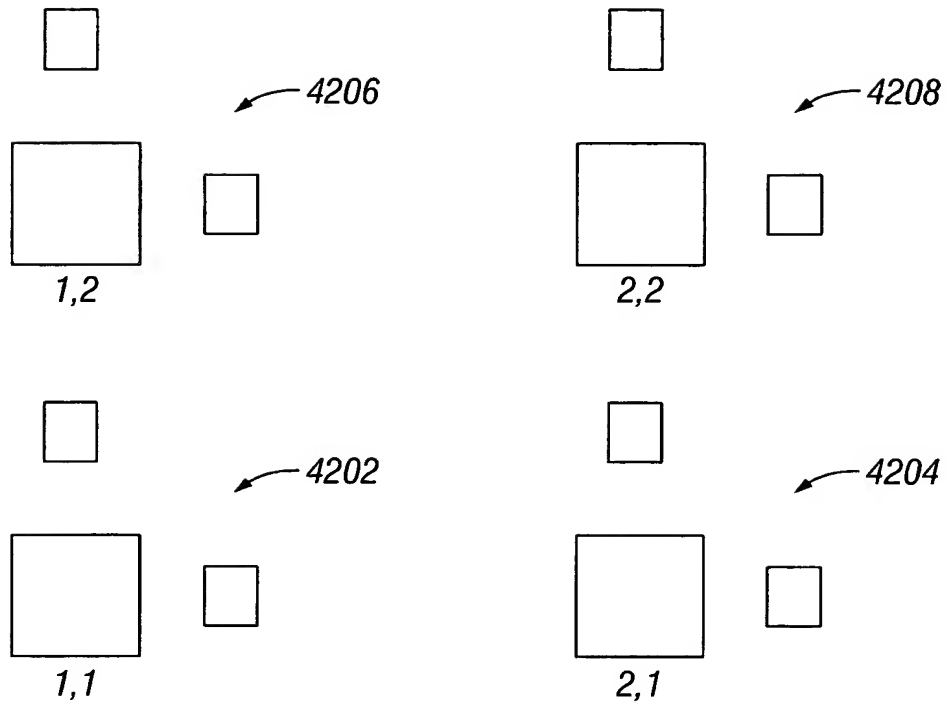


FIG. 42

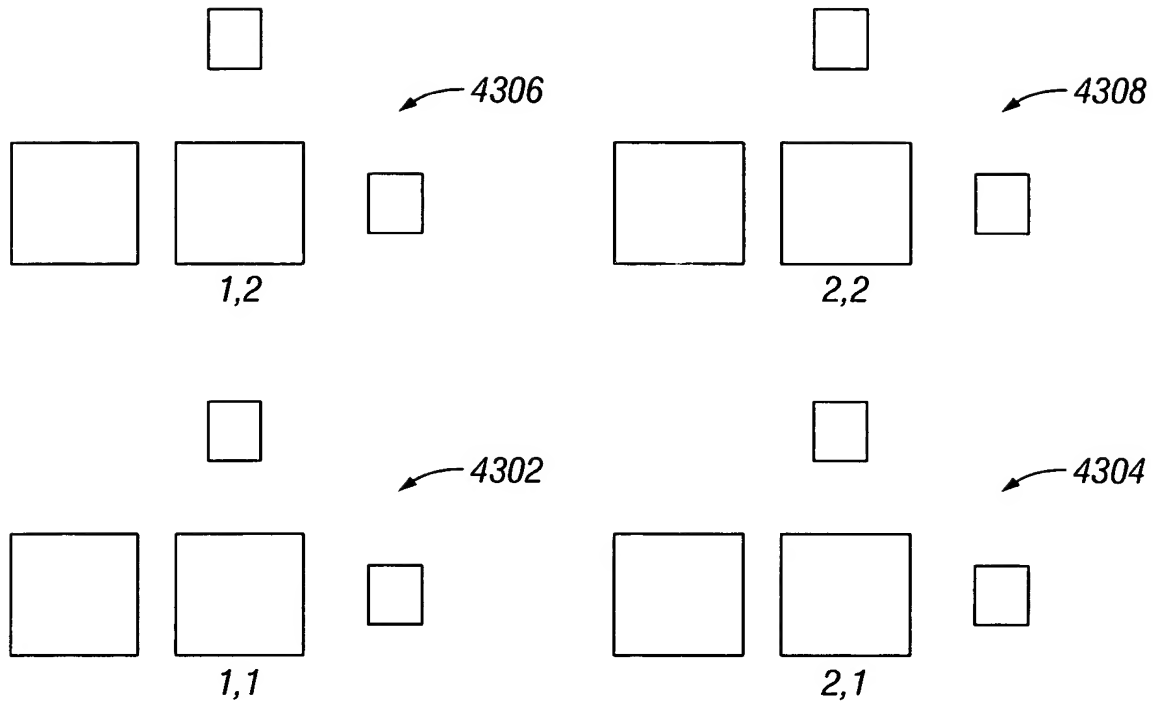


FIG. 43

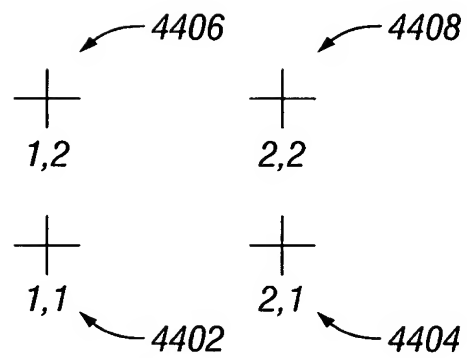


FIG. 44

REPLACEMENT SHEET
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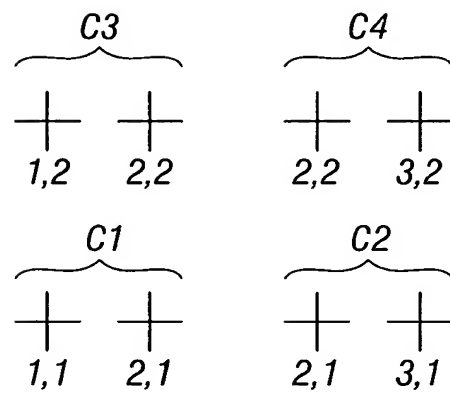


FIG. 45

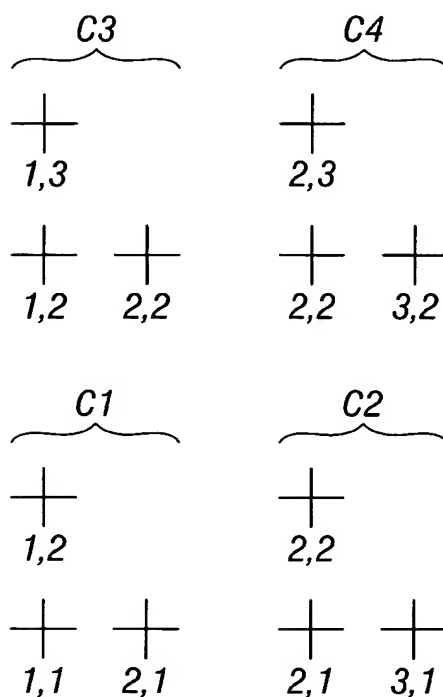


FIG. 46

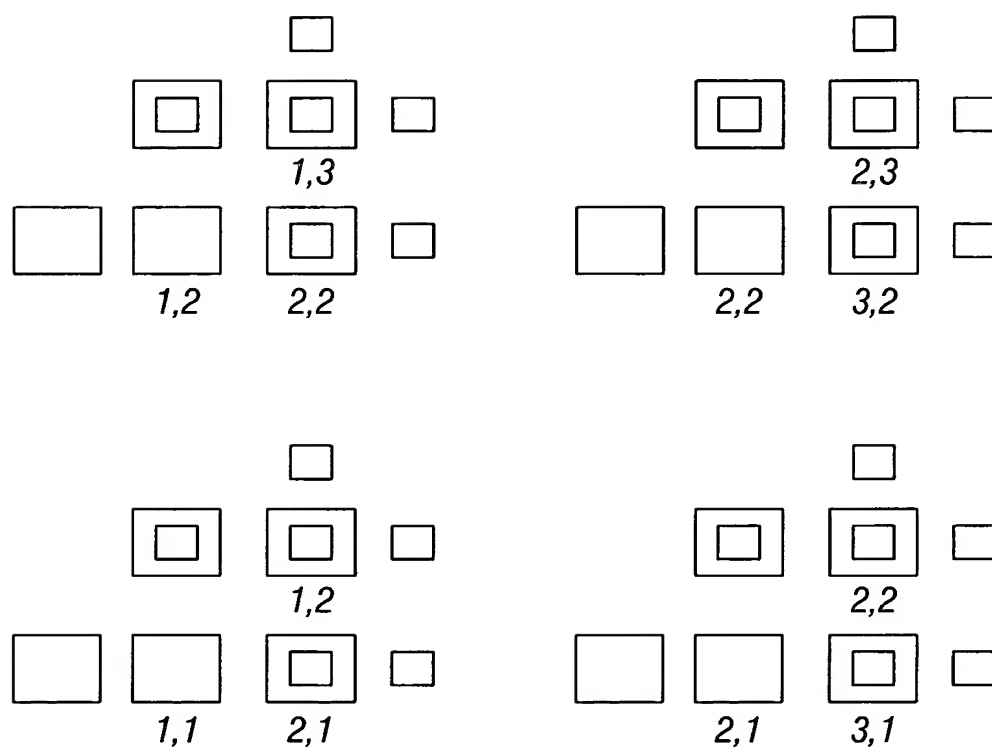


FIG. 47

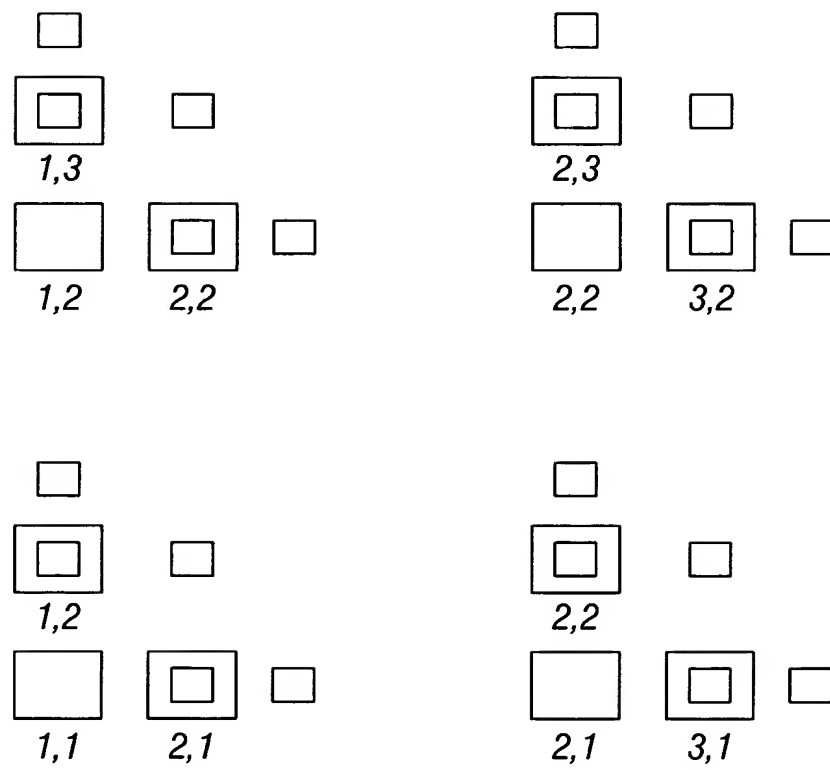


FIG. 48

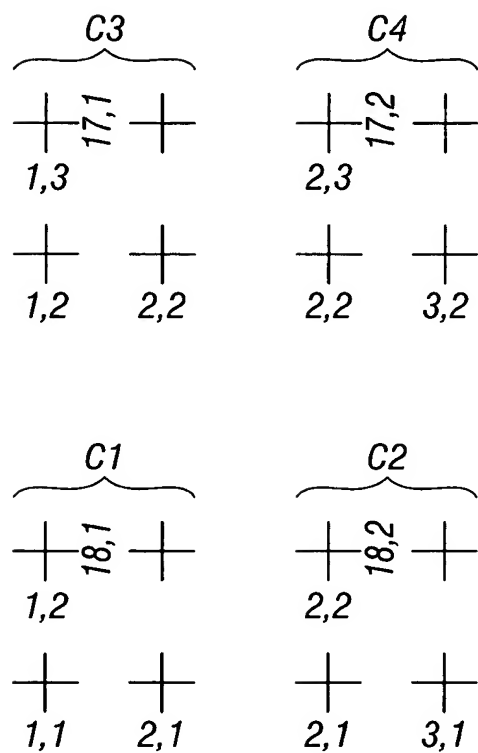


FIG. 49

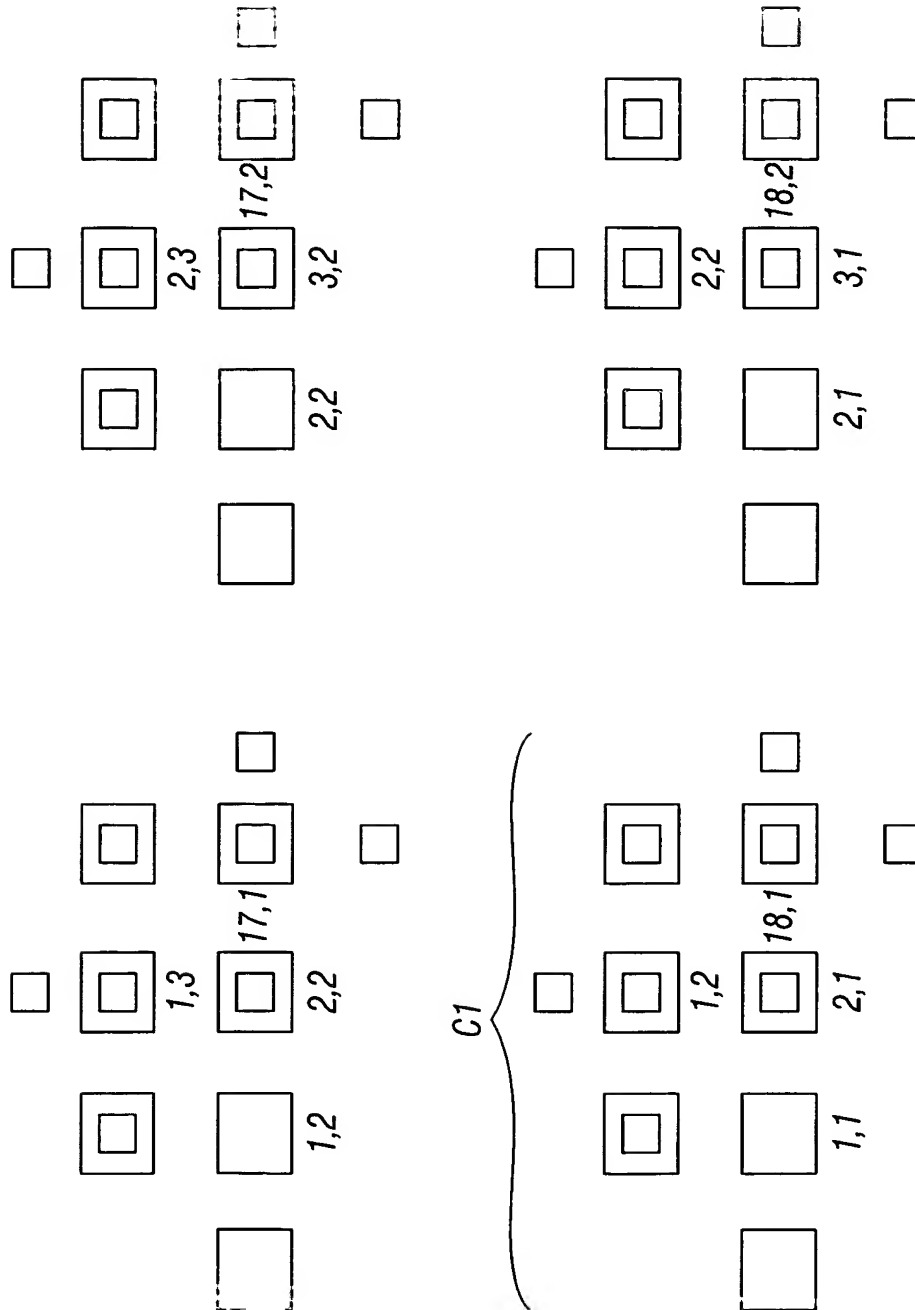


FIG. 50

FINAL RESULT FOR COMPUTATION OF x AND y TILT.
 (xf,yf)=INTRA-FIELD LOCATION IN MICRONS
 (a2, a3)=(x,y) TILT IN RADIANS

Machine id: DUVF11-03			
xf	yf	a2	a3
-10000	-10000	-0.15	0.06
-8000	-10000	-0.17	-0.42
-6000	-10000	-0.38	-0.01
⋮	⋮		
⋮	⋮		
10000	10000	0.11	-0.08

FIG. 51